

# The Multi-Cell SC CH-Cavity

A.Sauer, H.Podlech, H. Liebermann, U.Ratzinger

Workshop on the Advanced Design of Spoke Resonators

October 7 and 8, 2002  
Los Alamos, NM, USA

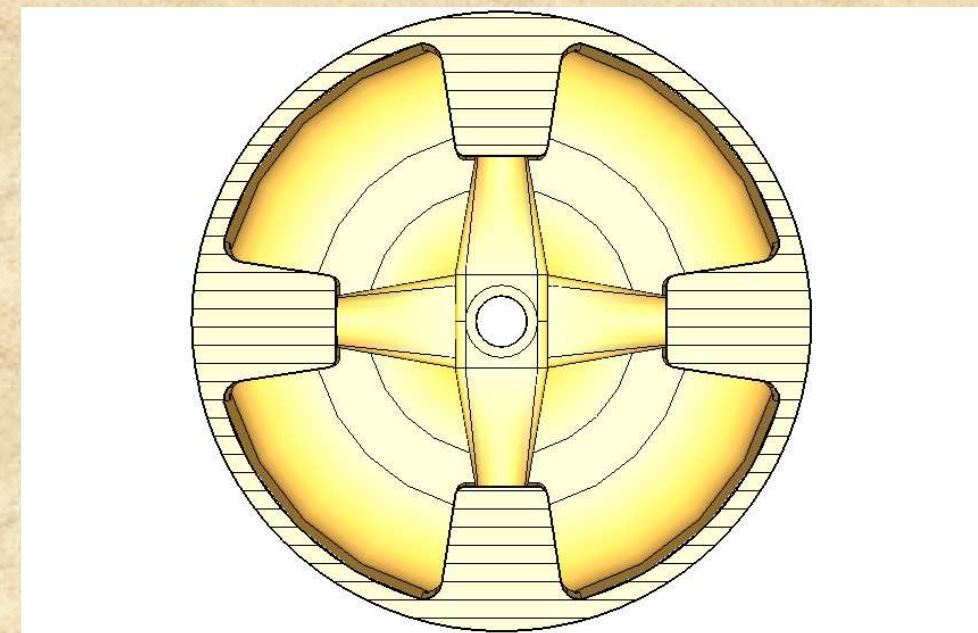
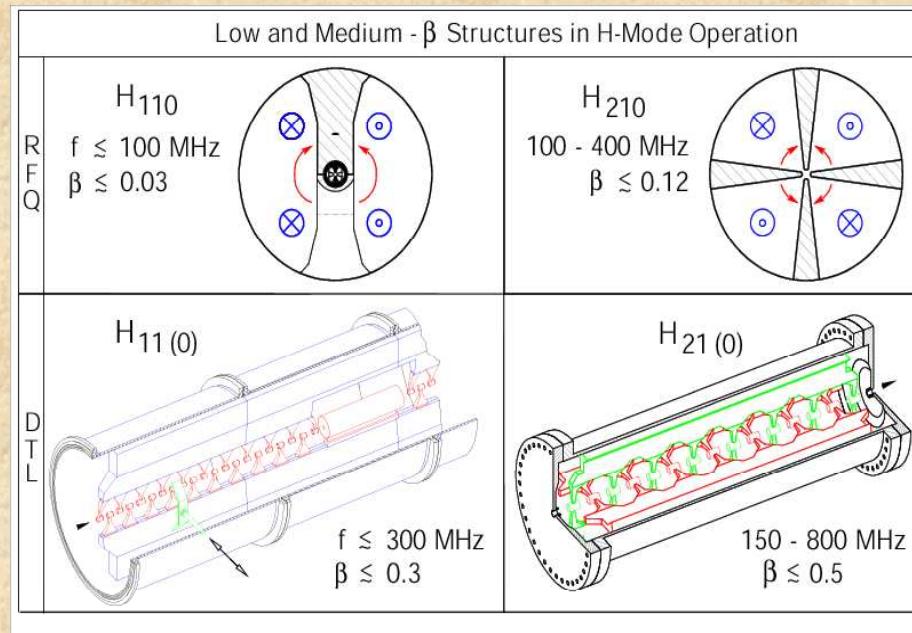
# Content

- The H<sub>210</sub>-mode
- Prototype development
- Possible applications
- Conclusions

## The $H_{210}$ -mode

→ 4-Vane-RFQ with short circuited dipole modes:

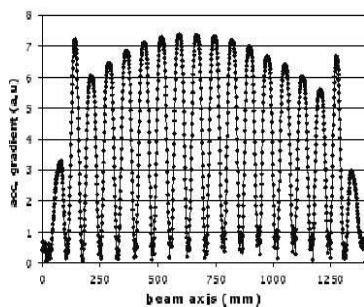
→ Cross-Bar-Array:



## Prototype developments

→ rt CH copper model: 1.) Analyzing higher order modes (near future) and field flatness,  
2.) Optimization of end cell geometry

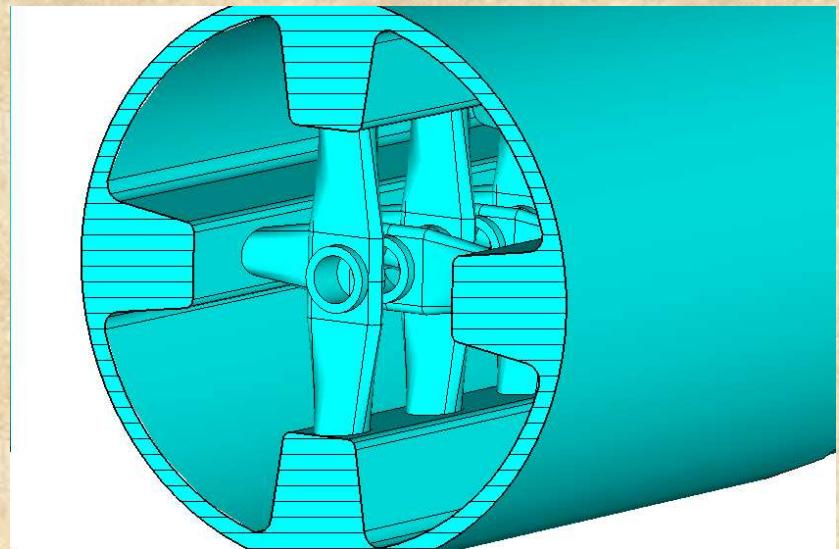
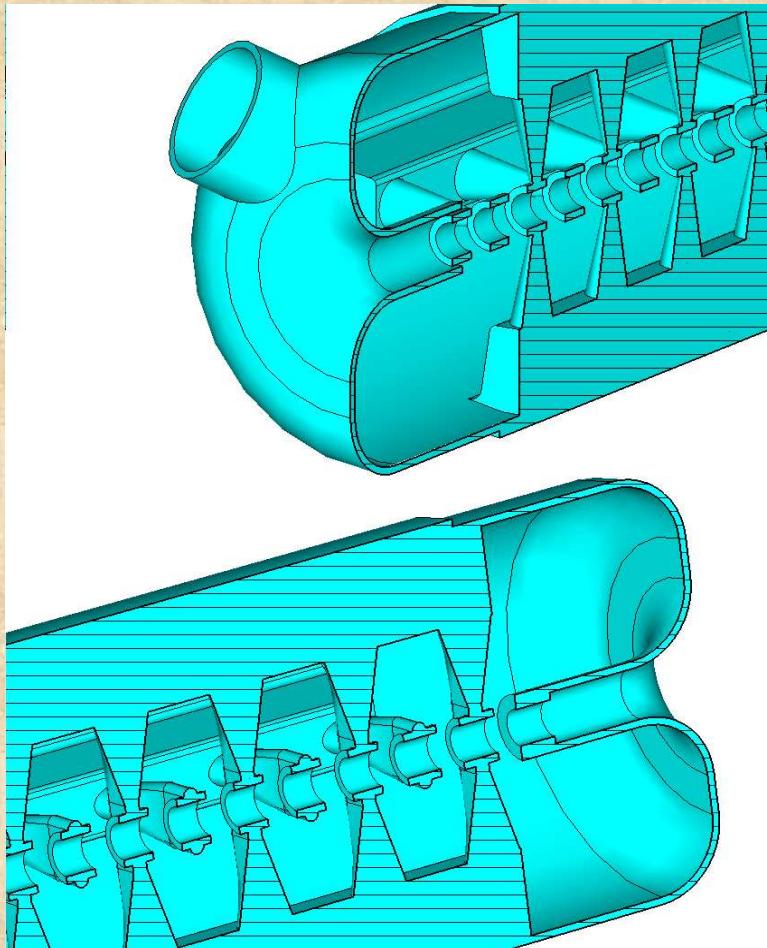
→ sc prototype geometry based on Micro-wave Studio simulations  
(protons,  $I=200\text{O}A$ )



On axis field  
(bead pull setup)

<b>Frequency:</b>	<b>352 MHz</b>
<b>Beta:</b>	<b>0.1</b>
<b>Tank length:</b>	<b>1.06 m</b>
<b>Number of gaps:</b>	<b>19</b>
<b>DT diameter</b>	<b>2.5 cm</b>
<b><math>E_{acc}</math></b>	<b>5.0 MV/m</b>
<b><math>B_{peak}</math></b>	<b>36 mT</b>
<b><math>E_{peak}</math></b>	<b>25 MV/m</b>
<b>Tank diameter</b>	<b>29 cm</b>

→ Detailed views of the prototype:



- Microphonics simulations studies underway with the program COSMOS
- Lorentz force detuning simulations up to now not planned (cw operation and low acceleration fields  $E_{acc} \approx 5 \text{ MV/m}$ )

→ Status of the cryogenic laboratory: Cryostat, magnetic shielding, laminar flow box class 100, fluid He from TU-Darmstadt in 250 l dewars, He recovery system

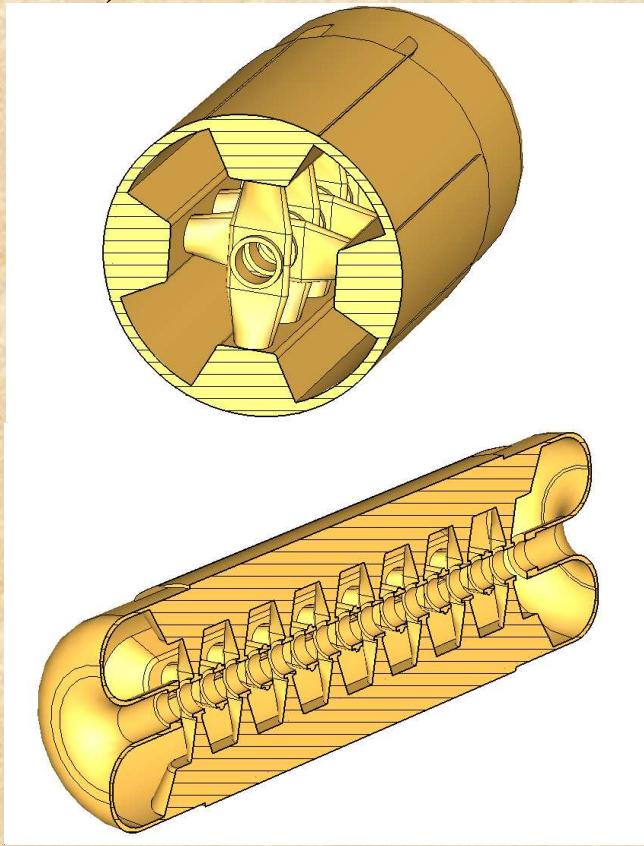


→ Technical design in progress and in close cooperation with industry:

- bulk Niobium
  - RRR-value:  $\geq 250$
  - material costs:  $\approx 100 \text{ k\$}$
  - thickness about 3 mm
  - 4 K operation temperature (first step)
  - 100 W Amplifier is foreseen (variable frequency 300 – 600 MHz)
  - connection of the resonator components with electron beam welding
  - magnetic coupling (first attempt) but with options for electric coupling
- ➡ at present call for tenders for prototype fabrication

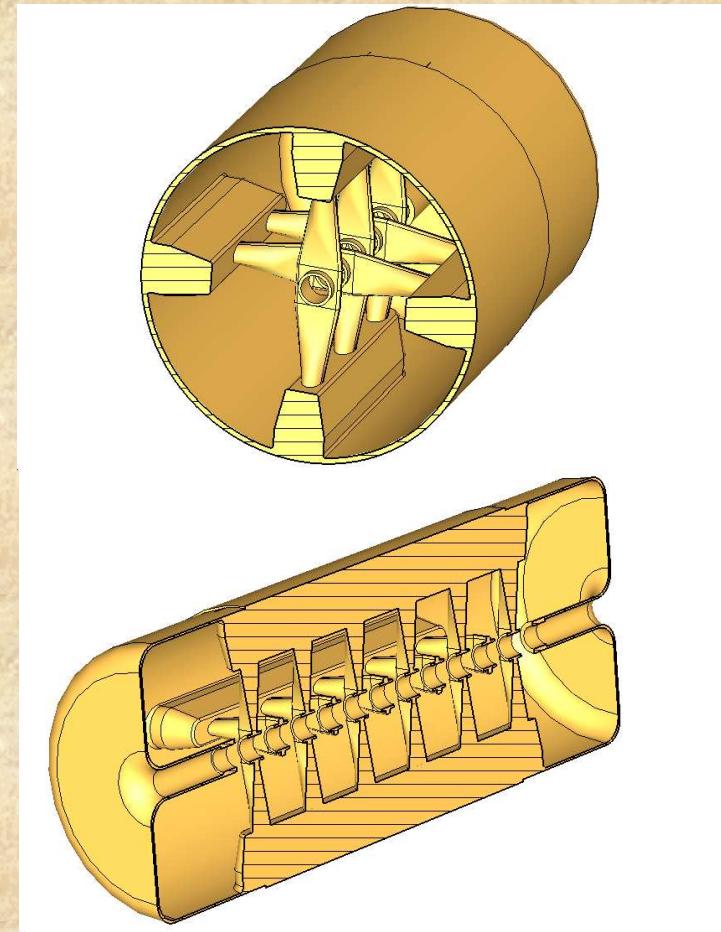
## Possible applications:

→ cw 350/700 MHz, < 40 mA, 100 MeV proton beams for ADS (Accelerator Driven System)



<b>Beta:</b>	<b>0.1</b>	<b>c</b>
<b>Frequency:</b>	<b>350.43</b>	<b>MHz</b>
<b>E<sub>acc</sub>:</b>	<b>5.29</b>	<b>MV/m</b>
<b>E<sub>peak</sub>:</b>	<b>25.1</b>	<b>MV/m</b>
<b>B<sub>peak</sub>:</b>	<b>44.6</b>	<b>mT</b>
<b>Tank length:</b>	<b>0.936</b>	<b>m</b>
<b>Drift tube diameter:</b>	<b>4.0</b>	<b>cm</b>
<b>Tank diameter:</b>	<b>26.8</b>	<b>cm</b>
<b>Number of gaps:</b>	<b>16</b>	
<b>E<sub>peak</sub>/E<sub>acc</sub>:</b>	<b>4.75</b>	
<b>B<sub>peak</sub>/E<sub>acc</sub>:</b>	<b>8.43</b>	<b>mT/MV/m</b>

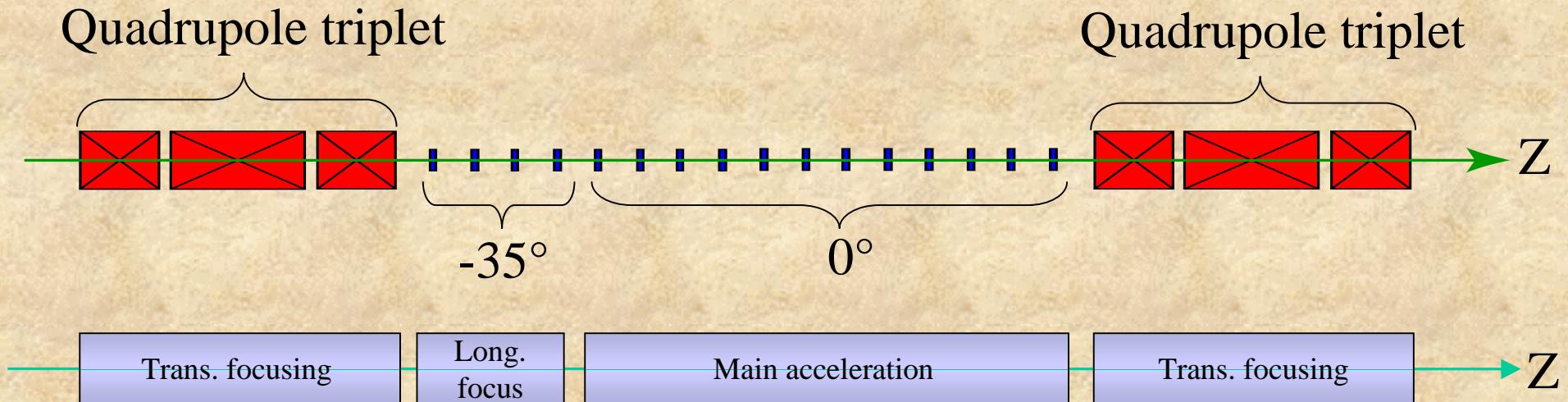
→ cw 175 MHz, 125 mA, 40 MeV deuteron beams for IFMIF (International Fusion Material Irradiation Facility)



### Preliminary (Optimization necessary)

Beta:	0.1	c
Frequency:	174.86	MHz
$E_{acc}$ :	5.35	MV/m
$E_{peak}$ :	38.7 → < 30	MV/m
$B_{peak}$ :	49.1	mT
Tank length:	1.52	m
Drift tube diameter:	5.0	cm
Tank diameter:	58.0	cm
Number of gaps:	12	
$E_{peak}/E_{acc}$ :	7.23	
$B_{peak}/E_{acc}$ :	9.17	mT/MV/m

- Dedicated for the KONUS (Kombinierte Null Grad Struktur) concept
- long lens-free sections



## Conclusions

- The sc CH-capabilities are promising
- Multicell sc CH design is attractive for fixed velocity, high current linacs
- Prototype development is in progress
- The first sc CH prototype cavity is expected to be ready for testing at the end of 2003

For more informations: Internet: <http://iap-ffm.de>

Email: [h.podlech@iap.uni-frankfurt.de](mailto:h.podlech@iap.uni-frankfurt.de) || [a.sauer@iap.uni-frankfurt.de](mailto:a.sauer@iap.uni-frankfurt.de)